

Dear Editors and Reviewers:

Thank you very much for your careful review and valuable suggestions regarding our manuscript titled “Comparisons and quality control of wind observations in a mountainous city using wind profile radar and the Aeolus satellite” (Manuscript Number: amt-2023-152). We appreciate the time and effort you have dedicated to reviewing our work. We have thoroughly studied your comments and have made the necessary changes to improve the manuscript. To provide a clear overview of the revisions, we have summarized the main corrections in the manuscript and provided specific responses to each of the reviewer's comments. You can find these revisions in the attached file "amt-2023-152-manuscript-version4.pdf" . We hope that these revisions have strengthened the manuscript and addressed the concerns raised by the reviewers.

Reviewer #1:

General comments

Wind profile observations are essential to atmospheric science, provides valuable information about the vertical structure of atmosphere and the movement of air masses. This study addressed the limited availability and low resolution of ground-based vertical wind observations in Chongqing, a typical mountainous city in China. To overcome this issue, the authors matched the Aeolus satellite track with ground-based vertical wind observation sites in Chongqing, with the year 2021 as an example. They then conducted verification and quality control studies on wind observations obtained from wind profile radar by comparing them with radiosonde data and the Aeolus satellite's Mie-cloudy and Rayleigh-clear wind products. Overall, this paper provides valuable insights into the comprehensive applications of multi-source wind profile data in mountainous cities with sparse ground-based wind observations. The findings contribute to improving the understanding of vertical wind profiles and emphasize the importance of quality control in vertical wind data analysis. This study is meaningful and I recommend this manuscript for publication in AMT after some revision:

Response: Thank you for the valuable and affirmative feedback and suggestions of our manuscript.

We will address each of your points in order:

1. Figure 2 illustrates the procedures of data matching and validation, which utilizes several abbreviations. As figures are independent of the text, please provide the meanings of these abbreviations either within the figure itself or its caption for the convenience for reading.

Additionally, please confirm whether it is RWD or WPR.

Response: We appreciate the reviewer for the careful comment and have updated the caption of Figure 2 to provide the meanings of the abbreviations used. The revised caption now reads as follows: "Flowchart of the multi-source wind profile data matching and verification procedures. WPR stands for wind profile radar, RS stands for radiosonde, EOF stands for empirical orthogonal function construction, and HLOS stands for horizontal line-of-sight." Additionally, we feel sorry for the mistake and have revised "RWD" to "WPR" in the figure. Please see Figure 2 in the revised manuscript.

2. In 2.2.4, the Aeolus HLOS wind products, including the Mie-cloudy and Rayleigh-clear wind products, are conducted quality control with two parameters derived from the Level 2B data products. However, I do not find any information about the number of excluded data and effect of this quality control on the overall datasets.

Response: Thank you for bringing this to our attention. Using the parameters `valid_flag` and `hlos_estimate_error`, 18241 Mie-cloudy wind profile samples and 1010 Rayleigh-clear samples were excluded. Through the quality control process, significant reductions in the estimated error were achieved for the Mie-cloudy wind products, from 42.22 m/s to 3.50 m/s. Similarly, for the Rayleigh-clear wind products, the estimated error has been reduced from 78.69 m/s to 4.58 m/s. We have incorporated these information in Line 224-229 of the revised manuscript.

3. In 3.1, This manuscript did not provide specific information regarding the missing data rate in the wind profile radar and radiosonde data used in the study. It is important to note that missing data commonly exist in ground-based observations due to various factors such as equipment malfunction, technical issues, or weather conditions. It is recommended that the authors provide relevant information regarding the missing data rate and discuss how they handled the missing data in their analysis.

Response: We are sorry for this neglect and have explicitly described these information in the revised manuscript. Specifically, the missing data rates are 22.78% for Shapingba WPR, 30.08% for Wulong WPR, and 13.55% for radiosonde data. Different approaches were utilized to address the missing data based on the nature of missing value. For cases where certain levels within a profile have missing values, linear interpolation is employed to fill in the missing data. On the other hand, if an entire layer of data is missing, the entire profile is removed from the analysis.

Please see Line 237-243 in the revised manuscript for details.

4. In Table 1, row 3 and row 2 are not aligned, please check.

Response: Thank you for addressing the formatting issue in Table 1. We have carefully checked and aligned all rows in Table 1 to ensure proper formatting and alignment in the revised manuscript.

5. The descriptions of Figure 5 in Line 271-286 are mainly qualitative description. The readers may want some specific data, such as the proportion of deviations concentrated between -10 to +10 m/s at various vertical levels, which could make the description more specific and objective.

Response: We appreciate your comment on revising the descriptions of Figure 5. We have annotated the proportion of deviations concentrated between -10 to +10 m/s at different vertical levels in Figure 5, and have added relevant description in the figure's caption. In the description of Figure 5, we have provided specific and objective analysis based on these information. Comparing RS with the original WPR data, 98.2% of the deviations distributed within the -10 to +10 m/s range near the surface. However, this proportion decreases with increasing altitude, with only 75.6% of the deviations falling within this range between 6-7 km. Furthermore, when comparing RS with the WPR data corrected using Gaussian filtering and EOF reconstruction, a higher proportion of deviations was observed to concentrate between -10 to +10 m/s at different altitudes. Specifically, the deviations between RS and EOFc WPR exhibit a higher proportion of deviations within the -10 to +10 m/s range compared to those between RS and GF data. Please see Figure 5 and Line 288-295 for the description in the revised manuscript.

6. Line 318-319, "The obtained results described in Section 2", what is the obtained results?

The author may want to say "the match procedure results", please rephrase this sentence.

Response: We feel sorry for any confusion caused and have rephrase this sentence in Line 336 of the manuscript.

7. Line 321-323, "The PDD ... generally present as, with 82.9% of deviations concentrated", should be "The PDDs generally present as ..., with 82.9% of deviations concentrating ...", please check the sentence.

Response: Thank you for addressing the correction in the sentence. We have corrected the sentence to say "The PDDs... generally present as..., with 82.9% of deviations concentrating..." to ensure proper grammar and clarity in Line 340 of the manuscript.

8. In Line 351-352, Line 362, what does the abbreviation “PWR” mean? I can not find its specific meaning in the previous text. Based on the context in line 56, the author may intend to refer to wind profile radar with abbreviation of “WPR” here. Please use the consistent abbreviation throughout manuscript.

Response: We feel sorry for the incorrect use of abbreviation. You are correct that the abbreviation "PWR" was not defined in the previous text. We have revised the manuscript to consistently use the abbreviation "WPR" to refer to the wind profile radar, ensuring consistency throughout the document. Please see Line 369-370 and 380 of the manuscript.

9. In Line 400, “Following screened by ...” should be “Screened by...”.

Response: We are appreciated with the careful comment and have corrected the sentence to say "Screened by..." instead of "Following screened by..." for improved clarity in Line 418 of the manuscript.

10. Line 412-413, please unify the tense of the entire sentence.

Response: Thank you for pointing out this grammar error. We have thoroughly reviewed the tense issue in the sentence and made the correction by changing "exist" to "existed" to ensure consistency throughout the sentence. Please see Line 429-430 of the revised manuscript.

Reviewer #2:

This study addresses the challenges of obtaining wind profile data in a mountainous city in China and demonstrates the importance of utilizing various data sources, including wind profile radar, radiosonde, and satellite-based Aeolus measurements. By matching Aeolus track data with ground-based observations and conducting comparisons with WPR and RS data, the authors provide insights into the correlation and discrepancies among these different measurement techniques. The paper showcases the significance of quality control techniques, such as Gaussian filtering and empirical orthogonal function construction, in improving the accuracy and reliability of wind observations. The analysis reveals the impact of these techniques on retaining wind characteristics and reducing deviations of WPR observations. Furthermore, the study investigates the differences between Aeolus Mie-cloudy and Rayleigh-clear wind products compared to WPR data. By considering factors such as boundary layer dynamics and cloud liquid water content, the authors shed light on the vertical distribution and discrepancies observed at different altitudes.

Overall, this paper highlights the importance of integrating and validating data from multiple sources in atmospheric measurement technology. The findings contribute to a better understanding of wind profiles in mountainous regions, where traditional ground-based observations are limited. The methodology and results presented in this study can guide future research and applications in similar geographical settings, ultimately advancing the field of atmospheric measurement technology and improving our understanding of complex wind patterns. This paper is worthy of publication for AMT with the following comments considered.

Response: We appreciate your efforts in reviewing our manuscript and providing valuable comments. Point-to-point response have been summarized as below:

1. The data acquisition rate, which represents the ratio of the actual obtained valid data quantity to the total expected data quantity, is an important quantitative indicator for assessing the detection capability of wind profile radars. It is suggested that the authors provide information about the data acquisition rate for the two radars of Chongqing in Section 2.1.1 to enable readers to better understand the detection capability of WPR in mountainous cities.

Response: Thank you for your suggestion. In the revised manuscript, we have provided information of missing data rates of both WPRs in Chongqing. The missing data rate can complement the data acquisition rate in characterizing the WPR's detection capability in mountainous cities. Please see Line 237-239 of the revised manuscript for the missing data rates of WPRs.

2. In Section 2.1, wind profiler radar, radiosonde, and Aeolus satellite data are described. As far as we know, these data are in different special and temporal resolutions. Therefore, it is necessary to provide information in the manuscript regarding the data quantities obtained from each measurement technique. This will facilitate a better understanding of the data-matching methods and enhance the credibility of the research.

Response: Thanks for this valuable comment. We have included information in the revised manuscript about data quantities of obtained from each measurement technique. Please see Line 224-227 for Aeolus, Line 237-239 for the description of WPR and RS .

3. In Line 60, the reference “Dibbern et al., 2001” is not found in the Reference part. Besides, the omission of reference for “WMO, 2001” in Lines 73-74 also occurred.

Response: We feel sorry for the neglect and have included the references in the Reference part.

The detail of “Dibbern et al., 2001” is:

Dibbern, J., W. Monna, J. Nash, and G. Peters. 2001. COST Action 76-final report. Development of VHF/UHF wind profilers and vertical sounders for use in European observing systems. European Commission, 350 pp.

While the detail of “WMO,2001” is as below:

World Meteorological Organisation (WMO). 2001. Statement of Guidance Regarding How Well Satellite Capabilities Meet WMO User Requirements in Several Application Areas, WMO Satellite Reports SAT-26, WMO/TD No.1052.

Please see Line 487-489 and 565-567 of the revised manuscript.

4. In Lines 75-76, the citation of “Baker et al., 2008” should be “Baker, 2008”, because there is only one author for this paper

Response: Thank you for pointing out the error. We have made correction following your suggestion in Line 75-76 of the revised manuscript.

5. In Lines 142-144, the expression in the sentence is strange, and “considering” may be revised to “to make up”. Please check and rephrase this sentence to make it more accurate and clear.

Response: We appreciate your suggestion on the expression and have changed "considering" to "to make up" as you suggested in Line 142-144 of the revised manuscript.

6. In Line 233-234, spaces are missing between the numerical values and their units, like “10km” and “850hPa”, please review the manuscript for this error.

Response: Thank you for pointing out this clerical error. We have reviewed the manuscript and correct this error. Please see Line 244 and 257 in the revised manuscript.

7. In Lines 254-255, “quality control 1” should be “Quality Control 1” or “the initial quality control”. Besides, I guess “WRP” at the end of the sentence should be “WPR”.

Response: We appreciate your careful comment and have made correction from “quality control 1” to “Quality Control 1”. Besides, “WRP” at the end of the sentence have been modified as “WPR”.

Please see Line 265-266 of the revised manuscript.

8. Lines 276-277, in the sentence “large positive deviations were mainly distributed around 3-5 km”, “were” should be deleted.

Response: Thank you for identifying the error. We have removed the word "were" from the sentence to improve its clarity in Line 288 of the revised manuscript.

9. In Figure 5, I wonder whether the word “RWP” in the legend should be “WPR” to match the abbreviations in the title of the figure.

Response: We appreciate your observation regarding Figure 5. We have updated Figure 5 and changed “RWP” in the legend to “WPR” in the revised manuscript.

10. In Lines 467-469, the publication year for the reference is not found, please check and make revisions.

Response: We are sorry for the neglect and have added the publication year for the reference in Line 484-486 of the manuscript.

Sincerely,

Authors